

# **Technology Deployments for D&D Applications**

**FY02 DDFA MID-YEAR REVIEW**

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# Introduction

- Relationship with US DOE
- Contract with Office of Science and Technology (EM-50)
- FY02 D&D Projects
- Conclusion

# US DOE / AEA Technology Partnership

AEA Technology is working with the US Department of Energy to transfer technologies and methodologies from the UK Nuclear Industry to address many needs across the complex, including:

- Hot cell decommissioning
- Tank waste sampling, mobilization, and retrieval
- Tank inspection and remediation

# Contract with Office of Science and Technology

- Task Order Agreement
- Projects split between DDFA, TFA, TMFA and HQ
- Term = 5 years
- FY02 Budget = \$4m

# FY02 D&D Projects

In FY02, AEA Technology is working with the DDFA on the following projects:

- ARTISAN<sup>TM</sup> deployment support at RL
- Mound tank waste mobilization and retrieval
- TA-50 sludge tank at LANL
- General's tanks at LANL
- Technical Assistance to DDFA

# ARTISAN <sup>TM</sup> Deployment Support at RL

# ARTISAN <sup>TM</sup> Deployment Relevancy / Technical Approach

- FY01 Scope:
  - Design, build, & test a hydraulic manipulator system for deployment in Bldg 324 at Hanford
  - Incorporate system improvements in the design
- FY02 Scope:
  - Design, build, test & deliver necessary structures to support deployment/maintenance
  - Train site operators and support installation

# Hanford ARTISAN™



# ARTISAN<sup>TM</sup> Deployment Relevancy / Technical Approach

- Project Goals:
  - Support the deployment of the ARTISAN in the Shielded Materials Facility at Building 324 on the Hanford site
  - Incorporate system design improvements to improve operating efficiencies
- Technical Approach:
  - Supply the necessary tooling, support structures, and training to support deployment

# ARTISAN<sup>TM</sup> Deployment Relevancy / Technical Approach

- Technology Maturity – project examples:
  - Decontamination of a Slovakian reactor facility
  - Maintenance of nuclear process plant in France
  - Waste retrieval system at Vandellos, Spain
  - Activated waste vault emptying at Trawsfynydd
  - Equipment removal from cell at the Dounreay
  - Waste handling and size reduction CEMP

# ARTISAN™ Deployment Relevancy / Technical Approach

- Technology Reliability:
  - Over 100,000 hours of documented operation
  - 97% Reliability
  - Industry Certifications:
    - UL-1740
    - Robotics, ANSI/RIA R15.06
    - Electrical, NFPA 79

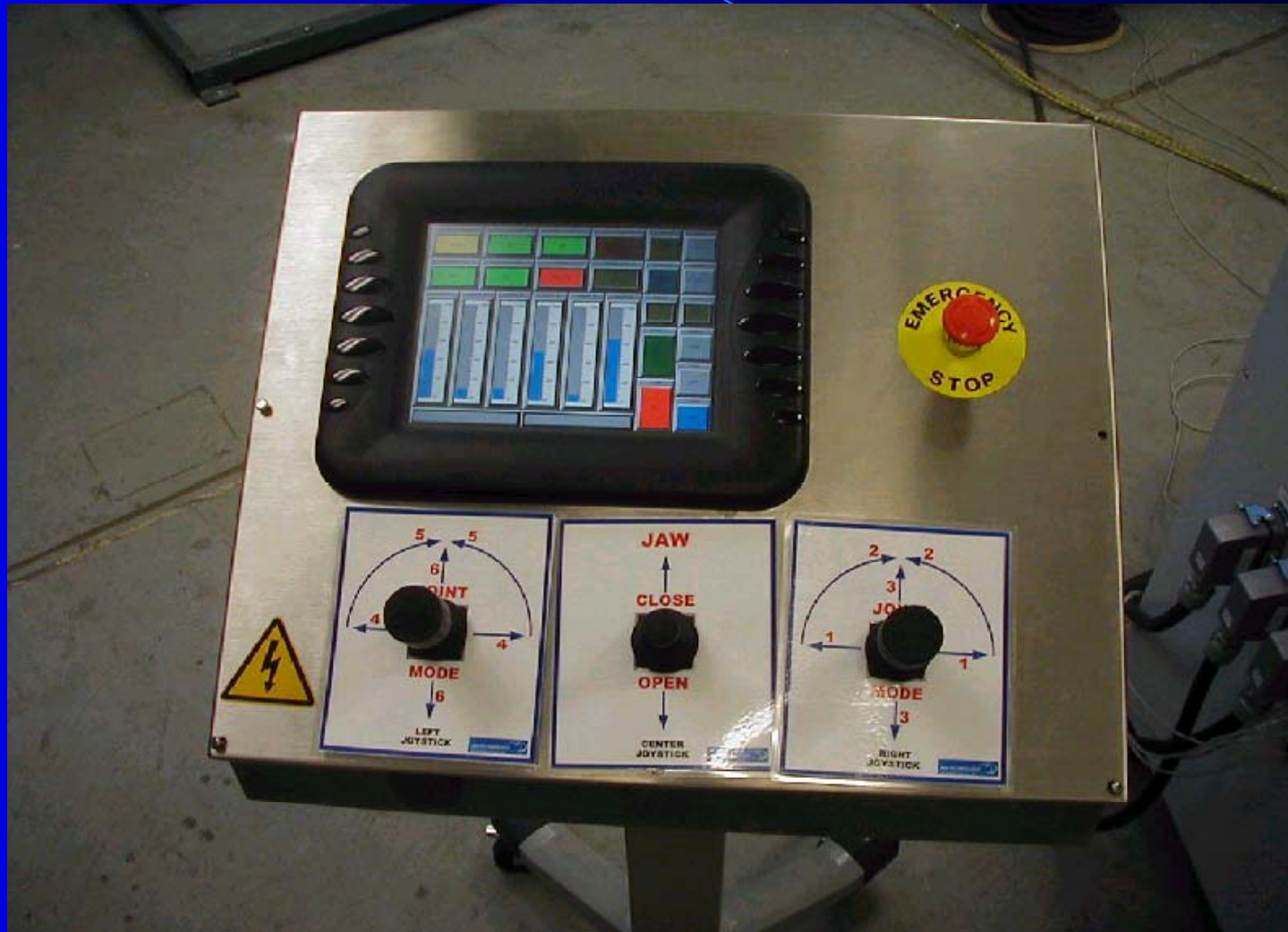
# ARTISAN™ Deployment Relevancy / Technical Approach

- Thrust 2 - ARTISAN™ manipulator systems are an alternative to high risk and high cost baseline MSMs
- FY00 ASTD Proposal estimated a \$1.25m savings
- Technical Advantages:
  - Longer reach
  - Higher payload
  - Teach and repeat functions
  - Improved operator interface

# Hanford ARTISAN™



# Hanford ARTISAN™



# ARTISAN<sup>TM</sup> Deployment Relevancy / Technical Approach

- Project's specific needs:
  - Longer reach – 10 feet
  - Higher payload – 200 pounds
  - Ability to reach ceiling – 360° first joint
  - Ability to deploy a variety of tooling
  - High radiation tolerance

# ARTISAN<sup>TM</sup> Deployment Relevancy / Technical Approach

- Schedule:
  - System was designed, fabricated, demonstrated, & tested in FY01
  - Required structures will be designed, fabricated and tested before delivery to site by early Spring 2002
  - Complete system is expected to be delivered to site in late March or early April 2002
  - AEAT will train site operators and oversee installation activities at Hanford immediately following delivery

# ARTISAN<sup>TM</sup> Deployment Relevancy / Technical Approach

- Other Technology Development Work:
  - Bldg 324 is deploying two remote handling systems. Capabilities and limitations of both systems will be thoroughly understood
  - ARTISAN<sup>TM</sup> system is being deployed at CEMP
  - Deployments will provide lessons learned and operational data to establish a new baseline for remote handling systems in hot cell facilities

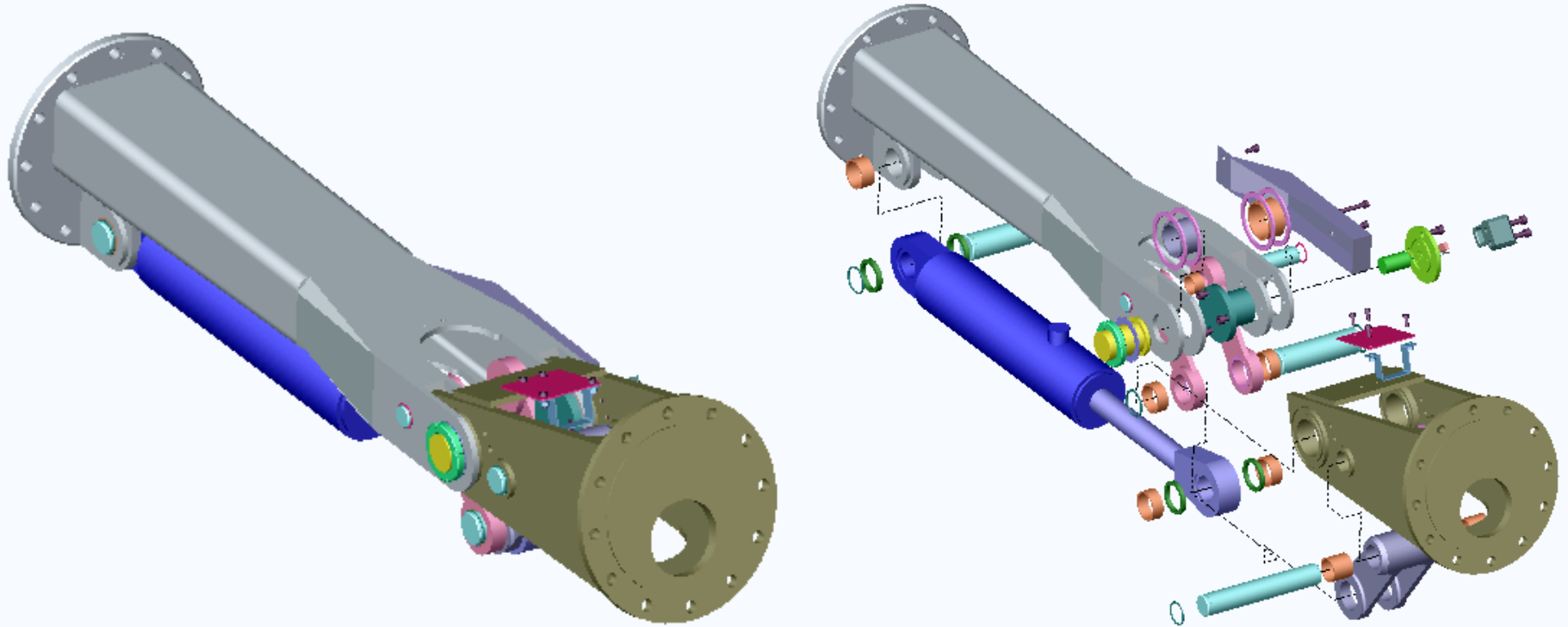
# ARTISAN™ Deployment Benefits

- Performance Characteristics:
  - Long reach – 8 to 12 feet
  - Higher payload – 200 to 400 pounds
  - Ability to reach ceiling – 360° first joint
  - Ability to deploy a variety of tooling
  - High radiation tolerance
  - Modular design
- Significant reduction in worker dose
  - Fewer required repairs on active equipment

# ARTISAN<sup>TM</sup> Deployment Benefits

- Safety benefits:
  - Operator's location
  - Operator's interface
  - Frozen position in the event of a power loss
  - Multiple E-stop buttons
  - Control software's safety features
  - Modular design for easy maintenance

# ARTISAN<sup>TM</sup> Deployment Benefits



# ARTISAN<sup>TM</sup> Deployment Benefits

- Thrust 2 – Alternative to Baseline
  - Current remote handling baselines for hot cell D&D at Hanford and CEMP are MSMs
  - ARTISAN<sup>TM</sup> system is an alternative to baseline
    - Deployable through existing manipulator ports
    - Ability to deploy a variety of tools
    - Easily recover capital expenditure
  - FY00 ASTD Proposal estimated a \$1.25m savings

# ARTISAN<sup>TM</sup> Deployment Technical Progress

- Progress in FY01 –
  - Designed, built, demonstrated, & tested ARTISAN<sup>TM</sup> system for deployment through a standard manipulator port
- Progress in FY02 –
  - Initiated the design for the installation structure and the maintenance/decontamination structure
  - Prepared required documentation for delivery

# ARTISAN™ Deployment Technical Progress

- AEAT Budget in FY01:
  - OST = \$450,000
  - Site = \$20,000
  - Total = \$470,000
- AEAT Budget in FY02:
  - OST = \$185,000
- Included complete system, testing, operating, maintenance & safety procedures, training, and required structures to support installation

# ARTISAN™ Deployment Technical Progress

- Project Schedule:
  - System delivery in late March 2002
  - On-site training in April 2002
  - AEAT will provide installation oversight
  - AEAT will provide on-call support
  - Site will deploy system in the SMF based on overall facility schedule

# ARTISAN<sup>TM</sup> Deployment Technical Progress

- ARTISAN<sup>TM</sup> system is commercially available from AEA Technology in a variety of deployment configurations, payloads, and lengths
- Facility contractor, Fluor Hanford, has committed to deploying the system in the SMF to facilitate D&D of the hot cells

# Mound Tank Waste Mobilization and Retrieval

# Mound Tanks

## Relevancy / Technical Approach

- FY01 Scope:
  - Transferred STM from OR to Mound
  - Designed, fabricated, and tested new nozzle
  - Deployed STM on two tanks at the WD complex to mobilize and retrieve 2,880 gallons of low-level radioactive sludge
  - Identified system improvements

# Small Tank Mixing System



# Small Tank Mixing System



# Mound Tanks

## Relevancy / Technical Approach

- Project Goals:
  - Design, fabricate, test and deploy an articulated nozzle to mobilize the crusted carbon sludge on the sidewalls of the tanks
  - Retrieve and transfer the waste to a neighboring tank within the facility
  - Successfully demonstrate the system's capability to mobilize and retrieve waste to:
    - Establish new baseline retrieval techniques
    - Accelerate facility closure schedule

# Mound Tanks

## Relevancy / Technical Approach

- Technical approach:
  - Design, fabricate, test and deploy an articulated, remotely operated nozzle on STM
  - Operate STM with new nozzle to mobilize and retrieve the crusted carbon sludge from the sidewalls of the tanks

# Mound Tanks

## Relevancy / Technical Approach

- Thrust 1 – Closure Site Support
  - The STM system is assisting the Mound closure site reduce its total inventory of waste in preparation for D&D of the facility
  - If the system proves successful in meeting the site cleanliness criteria, it may be deployed on the remaining 31 tanks and sumps in the WD complex to further accelerate schedule

# Mound Tanks

## Relevancy / Technical Approach

- Thrust 2 – Alternative to Baseline
  - The STM offers an alternative to the baseline of individual systems or manual operations on each tank
  - Skid mounted design allows it to easily be transferred from one tank to another with minimal interruption in operations
  - System is capable of retrieving a variety of waste consistencies from a variety of tank configurations

# Mound Tanks

## Relevancy / Technical Approach

- Specific needs:
  - Project required a mobile system capable of mobilizing and transferring a variety of sludges with varying weight percentages
  - System was limited to a small foot print
  - Project has a tight closure schedule

# Mound Tanks

## Relevancy / Technical Approach

- Timeliness:
  - AEA Technology will design, fabricate, test and deploy the new articulated nozzle by early Spring 2002
  - The site need to evaluate the system before issuing an RFP for waste retrieval from the remaining tanks and sumps in the facility
  - The site may include the system in an RFP for bidders to use as an option for waste mobilization and retrieval

# Mound Tanks

## Relevancy / Technical Approach

- Other Technology Development Work:
  - This is the first time the STM has been deployed with an articulated nozzle
  - AEAT is in the process of designing a tank waste mobilization and retrieval system for the TA-50 tanks at LANL and anticipates basing the design of the nozzle on the one being deployed at Mound
  - The Mound deployment will provide critical data to the LANL system design

# Mound Tanks

## Benefits

- Performance characteristics:
  - STM successfully mobilized and retrieved 2,880 gallons of low-level radioactive sludge from two below-grade storage tanks
  - System did not mobilize the crusted carbon sludge adhering to the sidewalls of the tanks
  - New nozzle will mobilize the crusted carbon sludge and retrieve the remaining waste

# Mound Tanks

## Benefits

- STM deployment will result in reduced worker dose by eliminating the requirement to manual mobilize and retrieve the waste
- The system is inherently safe to operate:
  - Does not introduce heat to the tank
  - No mechanical parts in contact with the waste
  - Highly radiation tolerant
  - Capable of mobilizing and retrieving sludges with varying consistencies

# Mound Tanks

## Benefits

- Alternative to Baseline:
  - The design of the STM offers an alternative to the baseline of individual systems or manual operations for each waste tank
  - The skid mounted design of the STM allows it to easily be transferred from one tank to another
- The STM system can potentially assist closure sites D&D tanks in a shorter timeframe and at a lower cost

# Mound Tanks

## Technical Progress

- FY00 Progress:
  - AEAT designed, built, tested, delivered, and operated the STM at OR as part of an ASTD project
  - System mobilized and retrieved waste from a single storage tank and transferred to MVST
- FY01 Progress:
  - STM was transferred to Mound
  - System mobilized and retrieved 2,880 gallons

# Mound Tanks

## Technical Progress

- AEAT FY01 Budget:
  - OST = \$276,800
  - Site = \$200,000
  - Total = \$476,800
- AEAT FY02 Budget:
  - OST = \$136,000
- Included transferred system, new nozzle, installation and operations

# Mound Tanks

## Technical Progress

- FY02 Schedule
  - Design of the articulating nozzle will be completed by March 2002
  - AEAT will operate the system to mobilize and retrieve the remaining waste
  - Operations are scheduled to be completed by the end of May 2002

# Mound Tanks

## Technical Progress

- The STM is commercially available
  - The primary skids can be transferred from one tank to another
  - A separate nozzle will need to be designed for tanks with different geometric shapes
- The STM is currently deployed at Mound
  - Site contractor and DOE representatives are discussing their options to include the STM in an upcoming RFP for waste retrieval

# TA-50 Sludge Tank at LANL

# TA-50 Tank at LANL

## Relevancy / Technical Approach

- FY01 Scope:
  - AEAT designed, fabricated, tested and demonstrated a prototype mock-up system for mobilizing and retrieving the waste from the TA-50 sludge tank at LANL
  - The system incorporated a proven power fluidic waste retrieval system and a remote controlled articulating nozzle
  - The system efficiently mobilized crusted sludge simulants from a rectangular test tank

# TA-50 Tank at LANL

## Relevancy / Technical Approach

- FY01 Results:

- Mobilized and retrieved waste simulants with varying consistencies
  - Simulants ranged in consistencies from a substance similar to vegetable oil to stucco

- FY02 Scope:

- Detailed design, fabrication, and delivery of tank waste mobilization and retrieval system
- AEAT will train site operators

# TA-50 Tank at LANL

## Relevancy / Technical Approach

- Project Goals:

- Detailed design, fabrication, and delivery of a tank waste mobilization and retrieval system that meets the site's requirements
- Operator training and installation oversight to assist the facility retrieve waste from leaking tanks, reduce the total inventory of waste, and improve operating efficiency for the waste treatment plant at LANL

# TA-50 Tank at LANL

## Relevancy / Technical Approach

- Technical Approach:
  - Complete the detailed design to meet QA and site standards
  - Fabricate and test system
  - Deliver system to LANL, train site operators, and oversee installation activities
  - AEAT will be available for on-call support, as necessary

# TA-50 Tank at LANL

## Relevancy / Technical Approach

- Thrust 2 – TA-50 tank waste mobilization and retrieval system offers an alternative to the baseline of sluicing and mechanical pumps.
  - Baseline estimate = \$2.5m per tank
  - TA-50 system = \$1m
    - System can be redeployed on multiple tanks (68)
- Rio Grande Fire forced site to re-prioritize legacy waste tanks

# TA-50 Tank at LANL

## Relevancy / Technical Approach

- Specific needs:
  - Project required a mobile system capable of mobilizing and transferring a variety of sludges with varying weight percentages from leaking tanks
  - System was limited to a small foot print
- Timeliness:
  - System will be deployed by late summer 2002
  - Subsequent deployments determined by site

# TA-50 Tank at LANL

## Relevancy / Technical Approach

- Other Technology Development Work:
  - AEAT is working with several sites to develop the final design of the TA-50 system
  - Multiple sites have storage tanks with unique geometries and crusted sludge adhering to the tank walls and internals
  - Other sites include; Mound, INEEL, Hanford, Knowles Atomic Facility

# TA-50 Tank at LANL

## Benefits

- Performance Characteristics:
  - Successfully mobilized and retrieved a variety of sludge simulants with varying consistencies from a rectangular test tank
  - System is based on the proven design of a Power Fluidic retrieval system

# TA-50 Tank at LANL

## Benefits

- The system is inherently safe to operate:
  - Does not introduce heat to the tank
  - No mechanical parts in contact with the waste
  - Highly radiation tolerant
  - Capable of mobilizing and retrieving sludges with varying consistencies
- Improved environmental safety by retrieving waste from leaking tanks
- Improved facility safety by reducing total inventory of waste

# TA-50 Tank at LANL

## Benefits

- Thrust 2 – Alternative to baseline:
  - Alternative to the baseline of sluicing and mechanical pumps.
  - Baseline estimate = \$2.5m per tank
  - TA-50 system = \$1m
    - System can be redeployed on multiple tanks
- Rio Grande Fire forced site to re-prioritize legacy waste tanks

# TA-50 Tank at LANL

## Benefits

- Schedule Benefits:
  - Mobile system can potentially assist closure sites D&D waste storage tanks in a shorter timeframe at a lower cost
  - Cost and schedule savings will be calculated upon completion of the first deployment

# TA-50 Tank at LANL

## Technical Progress

- FY01 Progress:
  - Designed, tested, and demonstrated mock-up system to mobilize and retrieve waste from a rectangular test tank
- FY02 Progress:
  - Kick-off meeting was in late January 2002
  - Progressing detailed design
  - Identified QA standards and initiated process of obtaining necessary permits

# TA-50 Tank at LANL

## Technical Progress

- AEAT FY01 Budget:
  - OST = 350,000
- AEAT FY02 Budget:
  - OST = \$500,000
  - Site = \$500,000
  - Total = \$1,000,000
- Includes complete system, testing, operating, maintenance & safety procedures, training, and installation oversight

# TA-50 Tank at LANL

## Technical Progress

- Project Schedule:
  - Complete detailed design and fabricate system during Spring 2002
  - Test and deliver the system early summer 2002
  - System deployment by late summer 2002

# TA-50 Tank at LANL

## Technical Progress

- The system is commercially available
  - The primary skids can be transferred from one tank to another
  - A separate nozzle will need to be designed for tanks with different geometric shapes
- Site contractor and DOE representatives have committed to deploying the system to retrieve waste from leaking tanks

# General's Tanks at LANL

# General's Tanks at LANL

## Relevancy / Technical Approach

- FY00 Scope:
  - AEAT designed and demonstrated a remotely operated sampling system for the high-level waste tank at Bldg 324 at Hanford
- FY01 Scope:
  - AEAT conducted and Options Study to identify the optimal approach to access the Retention Basin at INEEL to obtain video and retrieve samples

# General's Tanks at LANL

## Relevancy / Technical Approach



# General's Tanks at LANL

## Relevancy / Technical Approach

- FY01 Results:

- AEAT suggested a low cost mechanical arm to gain access to the Retention Basin to obtain video and retrieve waste samples
- The proposed system was very similar to the mechanical arm system designed for Bldg 324
- System would be capable of retrieving waste samples from various depths in preparation for D&D activities

# General's Tanks at LANL

## Relevancy / Technical Approach

- Project Goals:
  - Accelerate D&D schedule for the General's Tanks at LANL to allow the site to significantly reduce inventory levels and hand the facilities over as agreed
  - Reduce costs associated with the sampling and waste retrieval operations
  - Improve worker safety by eliminating the requirement to obtain manual samples
  - Demonstrate the system's applicability to the Retention Basin

# General's Tanks at LANL Relevancy / Technical Approach

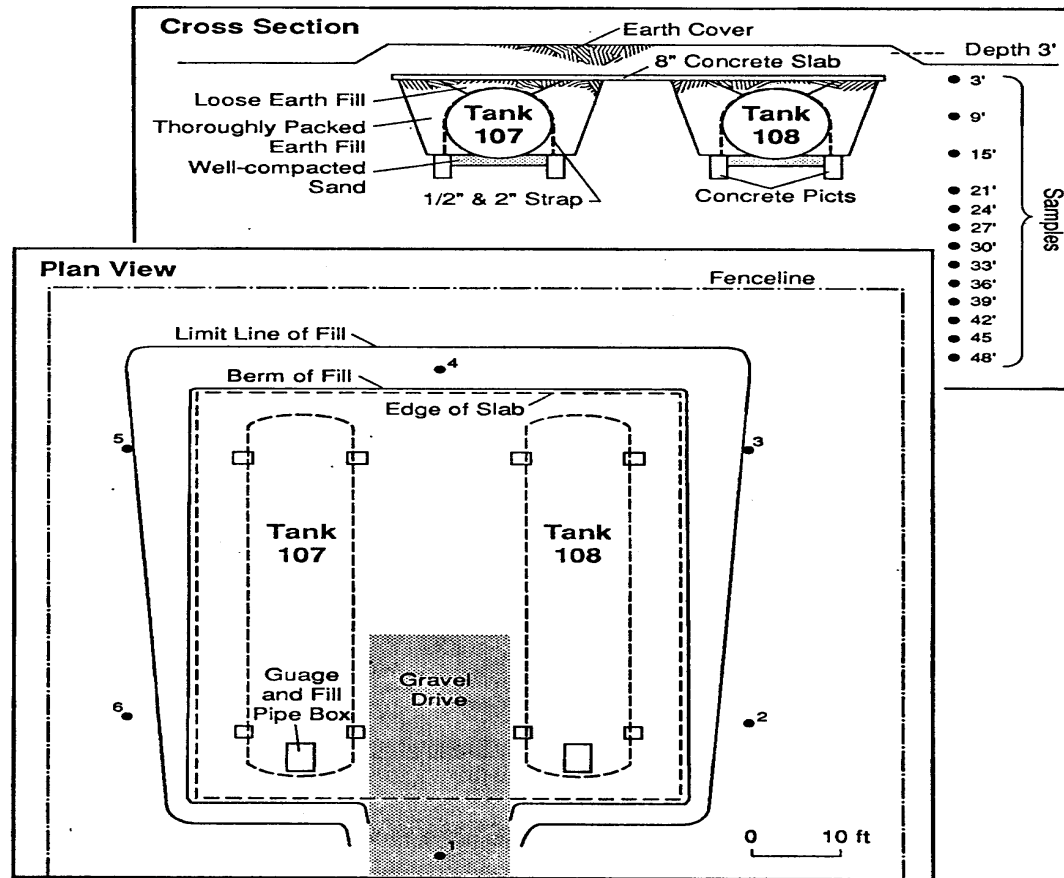


Fig. 16.8-5 1983 subsurface soil samples collected with "minuteman" drill (cross section). Locations perimeter to the "General's Tanks" as marked on map (plan view).

# General's Tanks at LANL

## Relevancy / Technical Approach

- Technical Approach:
  - Complete the detailed design, fabricate, test, and deliver a low cost mechanical arm to be deployed in the 50k gal General's Tanks at LANL to:
    - Determine contents of the tanks
    - Identify the consistency of any sludge
    - Obtain dosimetric readings
    - Perform a visual inspection
    - Retrieve waste sample from various positions within the tank for analysis
  - Train site operators and oversee installation activities

# General's Tanks at LANL

## Relevancy / Technical Approach

- Thrust 2 – Alternative to Baseline
  - The mechanical arm offers an alternative to the baseline of grab samples - Significantly reduces worker dose by removing the operator from the top of a tank
  - Provides more reliable, representative samples from a variety of locations within the tank
  - Provides additional information such as video, dosimetric readings, and grab samples
- Deployment of mechanical arm accelerates baseline schedule from 2004 to 2002
- Baseline characterization budget \$2m

# General's Tanks at LANL

## Relevancy / Technical Approach

- LANL TA-21 has the specific needs to:
  - Generate a D&D plan for the General's Tanks which requires the following:
    - Identify tank contents
    - Determine the consistency of any sludge
    - Obtain dosimetric readings
    - Perform a visual inspection
    - Retrieve samples for analysis
- System is expected to be deployed by late summer 2002

# General's Tanks at LANL

## Relevancy / Technical Approach

- Other Technology Development Work:
  - Deployment of the mechanical arm system at LANL provides critical lessons learned information to support the design of systems for the following applications:
    - Retention Basin @ INEEL
    - Sodium-bearing waste tanks @ INEEL
    - PM2A Tanks @ INEEL
    - T-105 at Bldg 324
    - Knowles Atomic Facility

# General's Tanks at LANL

## Benefits

- Performance characteristics:
  - Prototype mock-up system successfully obtained video and retrieved samples from a test tank during a demonstration for Hanford and DDFA representatives in FY00
- Deploying the remote operated mechanical arm system will remove operators from the hazardous environment during sampling operations

# General's Tanks at LANL

## Benefits

- Safety Benefits:
  - Remotely operated system removes operator from hazardous environment
  - Highly radiation tolerant
  - Capable of retrieving representative samples from various locations within the tank

# General's Tanks at LANL

## Benefits

- Thrust 2 – Alternative to Baseline
  - The mechanical arm offers an alternative to the baseline of grab samples - Significantly reduces worker dose by removing the operator from the top of a tank
  - Provides more reliable, representative samples from a variety of locations within the tank
  - Provides additional information such as video, dosimetric readings, and grab samples
- Deployment of mechanical arm accelerates baseline schedule from 2004 to 2002
- Baseline characterization budget \$2m

# General's Tanks at LANL

## Benefits

- The system will assist sites reduce time required to obtain samples, video, and dosimetric readings by combining the capabilities into one system
- The system will assist sites meet a regulatory requirement of obtaining representative samples
- Cost and schedule savings will be calculated after completion of the first deployment

# General's Tanks at LANL

## Technical Progress

- FY02 Progress:
  - Kick-off mtg. was held in late January 2002
  - Detailed design is underway
- FY01 Cost:
  - OST = \$100,000
- FY02 Cost:
  - OST = \$500,000

# General's Tanks at LANL

## Technical Progress

- FY02 Schedule:
  - Detailed design is underway and will be completed by late Spring 2002
  - Deployment is expected in the Fall 2002
- The mechanical arm system is a prototype design and will be deployed for the first time at LANL

# General's Tanks at LANL

## Technical Progress

- LANL DOE and Contractor representatives have committed to deploying the system in the General's Tanks to:
  - Meet regulatory requirements to obtain representative samples
  - Accelerate the characterization schedule
- Facility representatives have begun the process of obtaining required permits

# Technical Assistance to DDFA

# Technical Assistance Relevancy / Technical Approach

- AEAT has extensive experience deploying remote handling systems
- DDFA has requested access to that expertise through a technical assistance program
- AEAT will identify specific individuals to facilitate the information exchange to transfer over 20 years of experience

# Technical Assistance Relevancy / Technical Approach

- Project Goals:
  - AEAT will provide technical assistance to the DDFA in the following areas:
    - Proposal review
    - Review of new safety procedures
    - Assist the DDFA integrate available technologies
    - Participate on LSDDPs
    - Provide experts as needed for tasks to be defined

# Technical Assistance Relevancy / Technical Approach

- Technical Approach
  - Representatives from AEAT, EM-50 HQ, DDFA, and relevant sites will agree specific task orders prior to work being initiated
  - Task orders will include schedule, scope, budget, and project interfaces
- Specific Need
  - DDFA requires access to remote handling expertise

# Technical Assistance Relevancy / Technical Approach

- Timeliness:
  - A schedule for each task will be identified and agreed prior to work being initiated
  - Experts can be made available for specific applications with very short notice
  - AEAT has deployed numerous systems in a variety of configurations in Europe - Experience will be very relevant as sites determine closure schedules
- AEAT is supporting Hanford report

# Technical Assistance Benefits

- Performance Characteristics:
  - AEAT deployed a remote handling system at CEMP
  - AEAT will deploy a system at Hanford
  - AEAT has deployed numerous systems in a variety of configurations throughout Europe
  - Provides lessons learned and best practice experience

# Technical Assistance

## Technical Progress

- AEAT is supporting the WV LSDDP
  - Supporting monthly conference calls
  - Will assist preparing test plans
  - Support project demonstrations/evaluations
- AEAT is supporting Hanford by preparing a report summarizing available technologies in the UK and Europe that can be deployed at Hanford to address multiple project requirements

# Technical Assistance

## Technical Progress

- FY02 Cost:
  - A budget will be identified for each task
  - Current total budget = \$90,000
- FY02 Schedule:
  - A schedule will be identified for each task
  - Hanford report will be delivered by the end of March 2002
  - Participating on monthly WV LSDDP calls

# Conclusion

- AEA Technology is committed to providing the US DOE with innovative technologies to aid in the clean-up of the DOE complex
- The use of technologies proven in the UK and Europe benefits the DOE by:
  - Minimizing cost and schedule of projects
  - Increasing safety through the reduction of worker exposure